

Question No: 1

$$\text{Let } f(x, y) = 3x^3y^2$$

Find

(a) $f_x(x, y)$ (b) $f_y(x, y)$ (c) $f_x(1, y)$

(d) $f_x(x, 1)$ (e) $f_y(1, y)$ (f) $f_y(x, 1)$

(g) $f_x(1, 2)$ (h) $f_y(1, 2)$

Solution:

(a) $f(x, y) = 3x^3y^2$

find $f_x(x, y) = ?$

$$f(x, y) = 3x^3y^2$$

Apply partial derivative ^{w.r.t. x} on both sides

$$\frac{\partial}{\partial x} f(x, y) = \frac{\partial}{\partial x} (3x^3y^2)$$

$$f_x(x, y) = 3y^2 \frac{\partial}{\partial x} (x^3)$$

$$\left[\begin{aligned} \therefore \frac{\partial}{\partial x} f(x, y) \\ = f_x(x, y) \end{aligned} \right]$$

$$f_x(x, y) = 3y^2 \cdot 3x^2$$

$$f_x(x, y) = 9x^2y^2$$

(b) $f_y(x, y) = ?$ $f(x, y) = 3x^3y^2$

$$f(x, y) = 3x^3y^2$$

Apply partial derivative w.r.t. y on both sides

$$\frac{\partial}{\partial y} f(x, y) = \frac{\partial}{\partial y} (3x^3y^2)$$

$$f_y(x, y) = 3x^3 \cdot \frac{\partial}{\partial y} (y^2) \quad \left[\because \frac{\partial}{\partial y} f(x, y) = f_y(x, y) \right]$$

$$f_y(x, y) = 3x^3 \cdot 2y$$

$$f_y(x, y) = 6x^3y$$

(c) $f_x(1, y) = ?$ $f(x, y) = 3x^3y^2$

$$\therefore f_x(x, y) = 9x^2y^2$$

$$f_x(1, y) = ?$$

replace x by 1

$$f_x(x, y) = 9x^2y^2$$

$$f_x(1, y) = 9(1)^2y^2 = 9y^2 \text{ Ans}$$

(d) $f_x(x, 1) = ?$

$\because f_x(x, y) = 9x^2y^2$

Replace y by 1

$$f_x(x, y) = 9x^2y^2$$

$$f_x(x, 1) = 9x^2(1) = 9x^2 \text{ Ans}$$

(e) $f_y(1, y) = ?$

$\because f_y(x, y) = 6x^3y$

Replace x by 1

$$f_y(1, y) = 6(1)^3y = 6y$$

(f) $f_y(x, 1) = ?$

$\because f_y(x, y) = 6x^3y$

Replace y by 1

$$f_y(x, 1) = 6x^3(1) = 6x^3$$

(g) $f_x(1, 2) = ?$

$\because f_x(x, y) = 9x^2y^2$

Replace x by 1 and y by 2

$$f_x(1, 2) = 9(1)^2(2)^2 = 9(1)(4) = 36$$

(h) $f_y(1, 2) = ?$

$\because f_y(x, y) = 6x^3y$

Replace x by 1 and y by 2

$$f_y(1, 2) = 6(1)^3(2) = 6(1)(2) = 12$$